5. RIFS Study Tasks

5. REMEDIAL INVESTIGATION/FEASIBILITY STUDY TASKS

The end product of the OCVZ Focused RI/FS process is a record of decision (ROD) for OU-7-08. This Focused RI/FS process encompasses four separate but related activities:

- Remedial investigation
- Baseline risk assessment
- Feasibility study
- VVE treatability study.

The remedial investigation will collect and analyze existing data, and collect, validate, and incorporate new data to provide a data base for characterization of the plume, risk assessment, remedial action selection, and the VVE treatability study. Risk assessments are required at various steps in the Focused RI/FS process. For the OCVZ, a baseline risk assessment (BRA) will identify the risks of the no-action alternative to people and the environment. Various risk scenarios will be prepared for workers at the RWMC and residents living outside the RWMC. A feasibility study will be conducted to identify and screen alternatives which can be used to develop a remedial design that meets the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan. The feasibility study will use, as necessary, screening analyses, treatability studies, and engineering studies to identify, evaluate, and select a remedial action to reduce risks for OU 7-08. A treatability study will be conducted to evaluate and improve VVE technology for use on the VOC contaminants in the vadose zone. The details of the VVE treatability study will be presented in the treatability study work plan which will be developed.

Fourteen standard RI/FS tasks have been identified by EPA (EPA 1988b) to provide consistent reporting and allow more effective monitoring of RI/FS projects. The 14 general tasks that will be carried out as part of the OCVZ Focused RI/FS study are:

1. Project planning/scoping
2. Community relations
3. Field investigations
4. Sample analysis and data validation
5. Data evaluation
6. Risk assessments
7. Treatability study/pilot testing
8. Remedial investigation (RI) report
9. Remedial alternatives development and screening
10. Detailed analysis of remedial alternatives
11. Feasibility study (FS) report
12. Post RI/FS support
13. Preparation of ROD and proposed plan
14. Miscellaneous support.

The following sections describe the proposed activities within each task. The field investigation section describes proposed new field data collection activities. Specific details of proposed field activities are described in the sampling and analysis plan (SAP), which is Attachment III of this work plan.

5.1 Project Planning

The project planning process, of which this work plan is a part, involves efforts to initiate the Focused RI/FS study. Project planning is intended to identify types of actions that may be required to address site problems and to develop the proper sequence of site activities and investigations. Components of the project planning process include collecting and evaluating existing data, developing a preliminary conceptual model, identifying data needs and DQOs, identifying of preliminary remedial action objectives and potential remedial alternatives, identifying of treatability studies that may be required, preliminarily identifying ARARs, initiating of subcontract procurements, and preparing specific plans including this work plan, the attached health and safety plan (HSP), and the SAP. These components have been addressed in the previous sections of this work plan and attachments.

The following is a description of the plans developed as part of the project planning/scoping task. These plans are prepared in accordance with guidelines presented in the EPA guidance document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988b).

5.1.1 Work Plan

The Focused RI/FS Work Plan is prepared to present the initial evaluation and summary of existing data and information gathered in the scoping process. It documents decisions types identified during project scoping and proposes activities to be conducted in response to the identified decisions types. The Focused RI/FS Work Plan includes the following:

- A description of the site background and physical setting
- A project description including project management organization and responsibilities
- An initial evaluation and preliminary conceptual model of the site
- A discussion of data quality objectives
- A schedule for and description of the work tasks to be performed
- A schedule of deliverables to be generated in the Focused RI/FS.

5.1.2 Sampling and Analysis Plan

The field sampling plan (FSP) and quality assurance project plan (QAPP) are combined into a SAP. The SAP presents detailed procedures for the collection and analysis of environmental data for OU 7-08 (see Attachment III). The FSP presents the sampling objectives, the sample location and frequency, sample designation, sampling equipment and procedures, and sample handling and analysis. The QAPP presents the procedures that will ensure the quality and integrity of samples collected, the precision and accuracy of the analytical results, and the representativeness and completeness of environmental measurements taken for the vadose zone. The QAPP, written in accordance with current RI/FS guidance, includes the following elements:

- Project description
- Project organization describing lines of project responsibility and a listing of individuals responsible for ensuring the environmental data taken are valid
- Quality assurance objectives for data including required data precision, accuracy, representativeness, completeness, and allowed usage of the data
- Sample custody procedures and documentation
- Calibration procedures and frequency including a list of the calibration standards and sources to be used
- Analytical procedures with references to applicable standard operating procedures
- Data reduction, validation, and reporting procedures
- Internal quality control procedure description or reference
- Performance and system audits
- Preventative maintenance procedures
- Specific routine procedures used to assess data accuracy, precision, and completeness
- Corrective action procedures
- Quality assurance reports including results of system and performance audits and assessments of data accuracy, precision, and completeness.

5.1.3 Health and Safety Plan

The HSP details the health and safety measures to be implemented in conducting Focused RI/FS field activities at the site. It has been developed to ensure the protection of field personnel and site personnel during Focused RI/FS field activities. It includes a discussion on personal protective equipment, the types of environmental sampling techniques and instrumentation to be used, decontamination procedures, medical surveillance requirements, and applicable safety procedures. The HSP (see Attachment IV) includes the elements described in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH/OSHA/USCG/EPA) and 29 CFR 1919.120, "Hazardous Waste Operations and Emergency Response."

5.2 Community Relations

The community relations plan (CRP) is designed to ensure community understanding of action taken during the remedial response activities and to obtain community input on the Focused RI/FS program. Community relations is an integral part of any CERCLA action whether or not the action is on a Federal facility. At the INEL, a DOE Federal facility, all CERCLA actions will be subject to both CERCLA and NEPA community involvement requirements. The INEL Public Affairs group of EG&G Idaho has prepared a programmatic CRP (see Attachment II). The CRP will guide the actions taken to ensure appropriate public involvement in agency decisionmaking.

5.3 Field Investigations

This section of the work plan outlines the tasks that have been proposed as part of the RI and VVE treatability study to determine the nature and extent of volatile organic contamination plume in the vadose zone beneath and adjacent to the SDA, to evaluate the current and future risks posed to human health and the environment, and to develop a remedial alternative.

Before site characterization efforts are initiated, a standard geographic reference grid and data management system will be developed. The reference grid is necessary for development of a standard base map of the site to be used throughout the Focused RI/FS, and for definition of a coordinate system suitable for locating and naming sampling points. The development of a data management system is essential for the tracking, analysis, and integration of all physical and chemical data collected from the site. The data management system will be established during the early stages of the Focused RI/FS and will include data collected during field activities. In addition, any existing validated data that are appropriate for characterizing the site should be included. The data management system should be designed to provide user-friendly input, manipulation, and retrieval of data, as well as data output in the form of tables and graphs.

This section addresses the proposed field investigation and data development activities that will be required in filling data gaps identified for OU 7-08 (see Sections 3 and 4.3). The field investigations will focus on problem definition and will result in obtaining sufficient data to adequately define and evaluate remedial action alternatives.

The first two objectives of the OCVZ Focused RI/FS will be addressed primarily by the remedial investigation activities:

- Determine the nature and extent of the volatile organic contamination in the vadose zone beneath and adjacent to the SDA

- Determine the current and future risk posed by VOCs to human health and the environment.

The remaining two objectives will be addressed by a combination of remedial investigation and treatability study activities:

- Conduct treatability studies to develop and evaluate candidate remediation technologies

- Develop the appropriate remedial alternative.

The remedial investigation and treatability study activities can be divided into four areas:

- *Groundwater Investigation.* Several objectives have been established for groundwater studies for the OCVZ, including:

  - Groundwater elevation and quality

  - Aquifer parameters

  - Vertical concentration gradient in groundwater

  - VOC flux to groundwater.

  Evaluation of groundwater exposure pathway is the responsibility of the Groundwater Operable Unit (OU-7-06). However, the OCVZ BRA requires data on the groundwater pathway, because VOC flux to the groundwater and the potential for ingestion of VOCs via this exposure route may be an important contributor to the potential for adverse health effects. Data from the groundwater investigation begun in FY 1992 will be used to fill data requirements for the OCVZ BRA and Focused RI/FS.

- *Vadose Zone Investigation.* The subsurface soils have been sampled and analyzed to determine their volatile organic contamination level. In addition, the areal and vertical extent of the organic vapor plume in the subsurface will be defined using past soil-gas survey results and measurements of vertical organic vapor concentration gradients in the subsurface. The initial definition of the VOC vapor plume boundary in the subsurface will be the 1 ppmv carbon tetrachloride concentration isopleth, because 1 ppmv carbon tetrachloride in the gaseous phase equilibrates with an aqueous phase of approximately 5 ppb (the drinking water standard). The gaseous permeability and soil temperature will be measured. Perched water quality and location and groundwater quality and elevation will be determined. A survey of previous hydrogeologic and subsurface studies in the vadose zone will be made to assess existing subsurface data. Results from the groundwater, perched water, and subsurface vapor sampling program will be used to estimate the horizontal and vertical distribution of contaminants, estimate the contaminants' mobility, and predict the long-term disposition of contaminants in the vadose zone, groundwater, and atmosphere.

- *Air Investigation.* The extent of atmospheric contamination from the VOC contaminants found in the vadose zone at the RWMC will be investigated to determine the exposure of future residents and employees to the volatile organics released from the soil of the SDA. Elements of this activity include VOC concentration in the soil and vapor concentrations gradient measurements. This activity will assess potential of the contaminants to enter the atmosphere by monitoring local meteorological conditions including barometric pressure, wind-speed patterns, temperature, precipitation, and anticipated fate of airborne contaminants.

- *Treatability Study.* A pilot scale version of the VVE system will be operated to evaluate and improve the effectiveness of the VVE system for remediation of the vadose zone. Information from the study will support the feasibility study and aid the development of cleanup criteria for the ROD.

The following specific tasks were identified by DOE, EPA, IDHW, and EG&G, Idaho, Inc. The following task numbers refer to those task numbers identified in Section 4.3.5.6:

1. Soil temperature and vapor concentrations
2. Vapor port monitoring
3. Perched water
4. Vapor port permeability
5. Basalt tracer studies
6. Downhole barometric pressure/VOC concentration
7. Meteorological data
8. Stratigraphy and structural geology
9. Open well vapor sampling
10. Groundwater quality and elevation
11. VVE treatability study
12. Soil-gas survey (contingent)
13. VOC surface flux (contingent)
14. Soil moisture (contingent).

The objectives of the this section include identifying the types and goals of Focused RI/FS tests to be conducted for OU 7-08 and specifying the level effort required to conduct the tests. For tasks 1-10 and 12-14, specific details concerning a schedule for completing the activities and specifications for necessary equipment, vendors, and analytical services are provided in the SAP of this work plan. For task 11, specific details concerning the treatability study will be provided in the VVE treatability study work plan. Brief descriptions of the activities are presented in the following sections.

5.3.1 Soil Temperature and Vapor Concentrations

The objectives of this task are to provide information on the temperature profile of the surficial sediments in the SDA and measure concentrations of organic vapors of the surficial sediments in the SDA. Data will be used to determine the seasonal variations in vapor concentrations and temperature in surficial sediments as a check on the source term model. Vapor concentrations gradients also will be used to validate surface flux measurements.

Temperature data has been previously collected by Pittman (1989) at the Test Trench Area north of the SDA. Data on the soil gas within surficial sediments at the RWMC have been reported by Golder (1987). This was a one-time survey and all vapor concentrations were reported from samples just below land surface at typically 30 in. in depth.

Three wells will be drilled in the surficial soils to the top of the basalt inside the SDA and instrumented at multiple depths with vapor ports and a temperature measuring devices. Data logger(s) will be connected to record temperature on a daily basis for the remainder of the data acquisition time. The vapor ports will be sampled on a monthly basis and analyzed for VOCs with the field gas chromatograph. The resulting data will be compiled and a data report will be completed for this investigation.

Temperature data will be collected at three different locations and at multiple depths at each location. Temperature measurements will be collected every 2 hours throughout the day for approximately 10 months. The duration of the test (10 months) is adequate to evaluate temperature variability in the subsurface. Vapor samples will be collected on a approximate monthly basis at the same depths as the gas sampling ports. Samples will be analyzed for VOCs. Vapor concentrations will be compared with historical data. Three existing shallow wells will be instrumented with four vapor ports each and four thermocouples or thermistors.

Soil temperature is important hydrologic parameter because it plays a key role in a number of processes, such as:

- Evapotranspiration and its contribution to the net water flux at the air-soil interface
- Release of vapor phases from organic contaminants that have leaked into the sediments
- Vapor phase transport of VOCs and of soil moisture.

Soil temperature is a factor that must be included in the vadose zone models because of its strong effect on VOC vapor pressure and transport processes.

5.3.2 Vapor Port Monitoring

There have been several studies pertaining to VOC vapor concentrations in the vadose zone. A 4-month study was performed on 1990 to test the VVE process. Monitoring wells were sampled and analyzed during that time (Sisson and Ellis 1991). The monitoring wells have been sampled and the vapors analyzed periodically since then. In January 1991, the calibration gas was changed from benzene to carbon tetrachloride, thus improving data reliability. A dilution procedure was developed in August 1991. Samples were diluted to within the calibration range producing more accurate and precise results.

There are currently six boreholes at or near the RWMC SDA (three within the SDA and three outside the SDA) that have been instrumented with gas sampling ports. Each of these boreholes contain five to nine gas sampling ports (a total of 42 vapor monitoring ports) at various depths to monitor VOCs.

Six existing open wells within the SDA will be isolated with inflatable packers and samples will be taken from selected depths. These wells are uncased over portions of the wells. The well locations are presented in Figure 2-26. The uncased portions of the wells are as follows (Hubbell, 1991):

Well	Open Interval (ft)
D10	220-224
76-5	94-100
USGS 92	12-214
DO-6A	7-50
79-2	20-212
89010	90-249

From these six wells about 22 samples will be obtained. A vacuum pump will be connected to vapor port outlets and a vapor sample collected in a tedlar bag. VOC analyses (carbon tetrachloride, chloroform, and trichloroethylene) of the soil gas will be performed with a field gas chromatograph. Five percent of these samples will be sent to an outside laboratory for Level IV volatile organic analyses.

Gas sampling ports will be placed on six of the groundwater wells to be drilled in FY 1992 within the Groundwater Operable Unit (OU 7-06), Track 2. These wells will located outside the SDA and at least 36 vapor monitoring ports at selected depths to the aquifer (585 ft) will be installed. Gas sampling ports will be added to the outside of the casing in the newly drilled groundwater monitoring wells. The time of completion depends upon when the wells are drilled. Gas sampling ports (six ports) will be placed in USGS Well 118 at specific intervals and the well will be backfilled. These gas sampling ports will be used to collect the gas samples at selected depths within the subsurface. Details concerning the installation of these vapor ports are provided in the SAP for the Groundwater Operable Unit.

The VOC vapor concentration data from these ports and wells will be compared against the VOC plumes projected by past empirical data and computer modeling. Initial results from vapor port monitoring shall characterize the subsurface vapor contaminant plume and determine baseline levels of VOCs in the vadose zone; subsequent monitoring results will indicate VOC levels during the VVE process.

5.3.3 Perched Water

All existing data on known perched water zones in the vadose zone has been reviewed for location, depth, horizontal and vertical extent, hydraulic parameters, and water levels. EG&G Idaho has proposed a perched groundwater program, which was used as a basis for the Focused RI/FS data scoping process.

Preliminary evaluations of flow in the unsaturated zone and its relation to perched water zones should be determined by the perched water measurements. These evaluations should be based on the compilation and analysis of data on vertical infiltration rates for precipitation and melt water at the SDA in combination with information on the permeability of the confining layer.

The perched water measurements task has two primary objectives: (1) to measure the water level in all of the perched water wells and check for perched water in shallow open wells within the SDA, and (2) to collect samples of perched water for determination of CLP VOCs. When sufficient sample is available, perched water samples will also be analyzed for semi-volatiles, inorganics, radionuclides, and CLP metals. The gamma and metals data does not directly support the OCVZ Focused RI/FS but does help fill data gaps in the Rad and Metals Vadose Zone Operable Unit. The data needs and description of activities are described in the SAP (see Attachment III).

Perched water measurements are important to determine perched conditions acting as retardants for vapor transport. Perched water in five wells will be analyzed. Particular attention will be paid to seasonal variability in the water levels. The concentration of contaminants in the perched water and the amount of perched water are also important considerations in determining routes of exposure and the potential for adverse health effects in the risk assessment.

The sampling frequency of these wells may have to be adjusted based on the recharge rates and available volumes of perched groundwater. The samples will be analyzed for organic contaminants. A preliminary target analyte list is shown in Table 4-1. These data will be employed in the evaluation of the nature and extent of contamination of the perched water zones for OU 7-08 beneath the SDA.

Perched water monitoring will provide the depth and characteristics of perched water bodies under the SDA. The perched water bodies influence vertical permeability of the subsurface and thus the horizontal soil-gas movement relative to the vertical movement.

5.3.4 Vapor Port Permeability

Permeabilities of the basalt and sediments to air are needed for input into the VOC transport simulator. Permeability of the basalts varies by depth and relative position under the SDA. Because permeability is an important parameter in modeling and simulating VOC transport, improved estimates of permeability at each port location is important information.

The permeability tests require pumping gas from each port, while simultaneously monitoring the flow rate and port pressure over time. A pressure transducer is lowered into a sample port. A vacuum pump and flowmeter are then connected to the port. The pump is started and pressure changes are recorded on a data logger. In addition to permeability at each port, a sample will be collected after three sample tube volumes have been removed to obtain a valid VOC concentration sample. Two tests are referred to as sample port characterization in the SAP.

Each sample port must be characterized concerning the volume of soil gas that needs to be pumped to give a valid VOC sample. For example, at Well 8801D the port located at the 92-ft depth is in a portion of the plume where concentrations gradients of 200 ppm/ft at depth exist. Thus, at this port overpumping to obtain a sample would cause large errors in observed concentrations. Sample port characterization procedures are included in the SAP.

This test will be performed at all vapor ports on six existing vapor port monitoring wells, the vapor ports on the six new groundwater wells, and USGS 118.

5.3.5 Basalt Tracer Studies

Tracer tests consist of injecting a tracer gas at one point in the system and monitoring its concentration at other points in the system. Improved estimates of the travel times from point to point in the subsurface will enhance understanding of the existing transport phenomena. Monitor ports installed in monitor wells completed in the basalts can be used to inject and monitor tracer gas diffusing through the basalts and interbeds and define transport properties in these horizons. Result parameters that can be estimated from these tests are effective diffusion coefficients, and sorption properties.

The tracer gas must (a) be easy to detect at ppb level with minimal modification to existing gas chromatograph, (b) not be known to produce latent health problems such as cancer or asthma, and (c) be commercially available.

5.3.6 Downhole Barometric Pressure/VOC Concentration

Review of the VVE test results has indicated that some of the variation seen in VOC concentrations may be related to barometric effects. The purpose of this study is to generate data consisting of three data sequences: (1) barometric pressure, (2) VOC concentrations, and (3) the rate of barometric pressure change.

Barometric pressure is currently being obtained under other tasks at hourly intervals. VOC concentrations are being obtained under a different task of the VVE, however, a more frequent sampling program is required for correlation to the barometer and rate of barometric change. The barometric correlations require samples from periods of rising and periods of falling barometric conditions. To obtain data at the required times, an automatic sampler capable of collecting and storing at least 14 samples will be connected to the 50-ft-deep sampling port in Well 8801D and samples will be obtained at 12-hour intervals. Selected vapor samples will be analyzed for VOCs using the field GC based on the barometric pressure. The basis for sample selection will be variations in barometric pressure.

If it is determined from the barometric data logger that the barometric pressure has changed over that period, the samples will be analyzed for VOCs and any changes will be noted. If no barometric change is observed, the samples will generally be discarded and the automatic sampler restarted. Periodically, samples taken during no barometric change will be analyzed to test the null hypothesis.

5.3.7 Meteorological Data

A search of National Oceanic and Atmospheric Administration (NOAA) and existing airport data will be used to supply the necessary meteorological data during the testing periods and the required historical data. Various meteorological parameters are collected from the monitoring station at the RWMC. Atmospheric conditions will be monitored for barometric pressure, wind patterns (speed and direction), temperature, and precipitation. The objective of this task is to incorporate the existing meteorological data from environmental monitoring stations at the RWMC to aid in the characterization of transport and diffusion of VOCs.

5.3.8 Stratigraphy and Structural Geology

Stratigraphy and structural properties of the vadose zone beneath the SDA have been evaluated in past studies. Extensive drilling, coring, and logging operations have been conducted for the RWMC. A comprehensive literature survey has been performed to compile and analyze relevant data.

Further investigations will be made from information gathered during the drilling of the six groundwater monitoring wells in the Groundwater Operable Unit. Coring of the 110-ft and 240-ft interbeds will characterize the sedimentary interbeds in the aquifer. These cores will be obtained to determine if the extrapolation of information from shallow depths is appropriate. The geologic characteristics need correlation and interpretation to stratigraphic control points. Subsurface data should be used to estimate the paleo-environment during deposition of the deep interbeds. This would provide an estimate of sediment properties within the interbeds.

The objective of this study is to refine a description of the geologic stratigraphic section and describe the geological features most influential in VOC migration in the vadose zone. These geologic properties will be determined from geophysical logging operations as well as evaluation of subsurface cores incorporated into existing data.

Five types of geophysical logs have been performed in boreholes at the RWMC. These are gamma-ray, gamma-gamma, neutron, resistivity, and caliper logs. A downhole television log was run. These logging procedures will be performed on the six groundwater monitoring wells being installed under the groundwater operable unit.

Gamma-ray logs indicate the amount of natural gamma radiation emitted from material surrounding the hole. Gamma-ray logs are used to identify sedimentary beds within the basaltic sequence. Sediments at the SDA emit more gamma radiation than basalt.

Gamma-gamma logs measure the intensity of reflected gamma radiation from a source within the probe after it has been backscattered and attenuated within the hole and surrounding rocks. Gamma-gamma logs measure the relative density of material surrounding the probe. The logs, therefore, are also used to indicate relative porosity. Basalts show up as high density materials, whereas the sediments have a low density. Therefore, gamma-gamma logs suggest greater relative porosity in sediments.

Neutron logs measure the hydrogen content of material surrounding the hole, thereby reflecting the relative moisture content of the material. Sediment interbeds or fracture zones with sediment infilling within the basalt intervals typically indicate the highest moisture content. High levels of moisture fill the existing porosity reducing the effective porosity and vapor transport properties.

Resistivity logs provide a detailed picture of the character and thickness of various strata at the well site and an indication of the water quality by measuring the apparent resistivity of the materials surrounding the well bore. These logs also aid in well design and construction.

Caliper logs measure the diameter of the borehole. Knowing the diameter of the borehole allows for determination of the amount of borehole erosion that has taken place during drilling, the presence of swelling clays or resistant basalt layers in an otherwise friable rock, fracture patterns in basalt, volume of filter pack or cement grout required for well completion, positions of casing welds or joints, and areas where the casing has separated. Data from a hole caliper log are also extremely valuable in analyzing data for other types of logs where the readings are influenced by variations in hole diameter.

Borehole geophysical surveys along with detailed geological logging will spatially identify water-bearing zones in the vadose zone, aquifer porosities, and possibly fracture geometries; outline site specific geological controls on water movement; and define the site specific stratigraphy. Geophysical surveys and geological logs from the deep well or wells will provide stratigraphic information and geological controls on water movement deep within the aquifer.

During the Groundwater Operable Unit (OU 7-06) Track 2, coring of the 110-ft and 240-ft interbeds for six wells near the SDA will be performed. These cores will be tested for physical properties (i.e., density, porosity, gas permeability) and analyzed for chemical content (volatile organics, semi-volatile organics, inorganics, metals, and radionuclides).

5.3.9 Open Well Vapor Sampling

Vapor samples will be collected from open wells and analyzed by portable gas chromatography methods for carbon tetrachloride, chloroform, and trichloroethylene. Five percent of these samples will be sent to an outside laboratory for Level IV volatile organic analyses. The results of this analysis will help determine the VOC concentrations in the vadose zone above the 240-ft interbed. Vapor sampling of specific zones in the open wells will be achieved with down-hole packers. The well bore will be sampled with the vapor sampling pump. Details of the sampling procedure are outlined in the open well test plan appended to the SAP (see Attachment III).

5.3.10 Groundwater Quality and Elevation

Data collected by the USGS on groundwater quality and elevations over the past 25 years have been valuable in developing a conceptual model of the Snake River Plain Aquifer response to recharge from the spreading areas. The USGS has drilled a number of wells in 1971-1972 and 1987 under an ongoing site characterization program. A preliminary assessment of the hydrogeology of the RWMC was conducted in FY 1989 (EGG-ER-8694). Its purpose was to summarize and evaluate data associated with the Snake River Plain Aquifer in the vicinity of the RWMC. The study defined well installations and other work required to characterize the aquifer. A groundwater characterization plan was developed to evaluate the groundwater conditions for the SDA (Wood and Wylie 1991). This plan recommended the proposed upgrading the present monitoring network with the installation of 35 additional monitoring wells and core holes.

Several objectives have been established for groundwater studies for OU 7-08:

- Aquifer parameters
- Groundwater elevation and quality
- VOC flux to groundwater
- Vertical VOC concentration gradient in groundwater.

Evaluation of groundwater exposure pathway is the responsibility of the Groundwater Operable Unit (OU-7-06). However, the OCVZ Baseline Risk Assessment (BRA) requires data on the groundwater pathway, because VOC flux to the groundwater and the potential for ingestion of VOCs via this exposure route may be an important contributor to the potential for adverse health effects. Data from the groundwater/Snake River Aquifer investigation begun in FY 1992 will be used to fill data requirements for the OU 7-08 BRA and Focused RI/FS.

5.3.11 VVE Treatability Study

The objectives of the VVE treatability study are to:

- Further demonstrate the viability of VVE as a remedial alternative for the vadose zone beneath the SDA
- Optimize the VVE system performance and identify the optimum vertical zone of extraction
- Provide design criteria and design data for probable VVE scale-up for long-term remediation
- Provide operation, maintenance, and capital costs

- Provide data on VOC transport in the vadose zone beneath the SDA.

In pilot-scale studies, testing is usually limited to evaluating a few critical parameters with greater replication in order to optimize the technology's performance and test confidence. The pilot-scale VVE treatability study test design is based on a factorial design with two parameters and two operating levels. The two parameters are the vertical extraction zone and carrier-gas injection. The two operating levels for the extraction zone parameter are high VOC concentration zone and high permeability zone. The two operating levels for the injection parameter are "on" and "off."

Within the VVE treatability study several tasks will be performed; however, they are components of the prevalent treatability study test design. Other tasks to be performed during the treatability study include tracer studies, off-gas treatment evaluation and operation, extraction well flow and pressure tests, installation of the injection well, installation of the monitor well, and cold weather operation.

The following activities (VOC surface flux, soil moisture, and soil-gas survey) will only be done if the first phase of field activities and review of those data determines that they are needed for the BRA to determine VOC being released to the air pathway.

5.3.12 Soil-Gas Survey (contingent)

Golder Associates performed a soil-gas survey of the near surface (approximately 30 in. depth) surficial soil at the SDA during October 28 through November 6, 1987 (Golder, 1987). The survey covered all of the SDA and about 600 ft beyond the SDA fence. A total of 136 samples was collected on a grid of 200-ft spacing at a depth of approximately 30 in. The analysis results reported by Golder (1987) were those concentrations at or above the reporting limits. Levels above the reporting limit were found for four volatile organic compounds: carbon tetrachloride, tetrachloroethylene, 1,1,1-trichloroethane, and trichloroethylene. The highest concentrations of the four organic compounds were found above burial pits. Sampling within the SDA is a contingent activity during this RI/FS.

The purpose of this survey will be to determine the identity, location, and relative concentration of selected chlorinated VOCs in the vadose zone within the SDA.

Soil gas will be extracted by driving a 5/8-in. OD steel probe approximately 30 in. into the ground using a slide hammer or a hand-held electric rotary hammer drill. Soil vapor will be drawn from the ground through a flexible Teflon tube inside the probe using an applied vacuum. The gas sample will be collected in a Tedlar bag. Analysis of soil-gas samples (carbon tetrachloride, chloroform and trichloroethylene) will be performed in a field laboratory with a field gas chromatograph (GC).

The proposed second soil-gas survey will reestablish the areal distribution of active VOC sources in the pits and trenches and will provide some relative measure of their activity. The survey will also determine whether changes in organic vapor concentrations have occurred and to further characterize the soil-gas distribution for the organic contamination in the vadose zone.

5.3.13 VOC Surface Flux (Chamber) (contingent)

VOCs enter the air pathway by diffusing across the soil surface or evaporating from contaminated soil transported to the soil surface. Knowing the VOC flux across the soil surface and having measured atmospheric stability parameters allows direct computation of exposure levels through the air pathway. Surface flux measurements are needed to provide VOC releases to the air and estimates of worker exposure to VOCs. The VOC surface flux is important in projecting the time variations of the VOC plume in the vadose zone. The VOC flux across the soil surface will be estimated using a flux chamber. The purpose of this study is to estimate the flux during typical soil conditions (i.e., wet, dry, frozen) while simultaneously estimating or measuring soil moisture content, surface permeability, and soil temperature.

Five locations will be selected in the SDA for surface VOC flux measurements. These sites will be located from the soil-gas survey. Three sites will be placed on high-VOC locations, one on a mid-range location, and one on a low-VOC location. VOC flux estimates will be performed 3 times at each location and soil condition. The values will be averaged to achieve the desired precision in flux rates. VOC flux estimates will be performed under three different soil conditions or seasons during the RI at each site to determine the effect of seasons and weather. The effect of soil surface temperature and soil moisture on the VOC flux will be estimated during the surface flux testing.

Soil surface temperature will be estimated using a thermocouple on the soil surface (shaded from the sun). Surface soil moisture content will be estimated using a surface moisture gauge. Surface permeability will be estimated using the air permeameter described by Tanner and Wengel (1957) and the data analysis method of Grover (1955). See soil moisture monitoring, soil temperature monitoring, and surface permeability tests in the SAP (Attachment III) for calibration and experimental methodologies.

Flux chamber procedures are described in the Appendix F of the SAP. Briefly, the test consists of placing the chamber on the site, establishing a known flow of uncontaminated air into the chamber, and sampling the exhaust stream for VOC concentrations. Once a steady value of VOC concentration is observed in the exhaust stream the test is complete and the apparatus is moved to the next site. Data analysis assumes that the flux from the soil surface is completely mixed with the clean air passing through the chamber and that the chamber does not significantly influence the VOC flux rate from the surface.

5.3.14 Soil Moisture (contingent)

The task objective is to obtain the soil moisture profile within surficial sediments from approximately 12 locations within the SDA. Data will be collected on the soil moisture profile on a periodic basis throughout the year to determine the potential infiltration rates, distribution of moisture content, and effective soil porosity within the SDA. These data will also be used in the organic transport models.

Soil moisture data has been previously collected inside the SDA and reported by Laney et. al. (1988) and McElroy (1990). Refer to Laney (1988) for a description of the project monitoring objectives and data collected.

Soil moisture profiles in the surficial sediments will be measured using a neutron moisture probe (Campbell Pacific Hydroprobe). Twelve holes will be drilled at the RWMC around pits and trenches to depths of not greater than 30 ft. Selected holes will be sampled and soil moisture content analyzed. These locations will be drilled through the surficial sediments and drilling terminated at the top of the basalt. A neutron access tube will be inserted into these boreholes immediately following drilling to minimize moisture lost from the soil. A probe containing neutron source and detector will be lowered into the soil through an access tube. Moisture profile in the surficial sediments will be measured periodically.

The neutron probe measurements will be calibrated with conventional soil moisture measurements using core samples from selected neutron probe holes. Procedures for use of the Hydroprobe are presented in Hubbell, Hampton, and Hull (1988).

The neutron moisture gauge measures the moisture content in the soil by supplying a source of fast neutrons that are slowed by the presence of hydrogen in water. The slow neutrons are detected and counted. This count can be correlated to moisture content. The data are presented as the count rate to examine relative changes in moisture content. Higher count rates correspond with higher moisture contents.

The access tubes are standard 1.5 in. Schedule 40 pipe. They are installed by digging a hole with a hand augur, taking moisture samples at various depths, then pushing the tubes into the ground. The moisture samples can be utilized to calibrate the instrument with the soils. Readings can be taken at any depth or time interval. The readings are taken by lowering the source down the access tubing and activating the counter on the gauge.

5.4 Sample Analysis and Validation

Sample analysis involves efforts relating to the analysis and validation of samples after they leave the field and includes development of sample management and quality control procedures. The methods and protocols that will be used in the analysis of samples collected for OU 7-08 are described in the QAPP, which is included in the SAP (see Attachment III). The QAPP provides site-specific information on data management, field measurements and calibrations, laboratory calibrations and procedures, project organization and responsibility, field sampling techniques, and analytical methods. The goal of the QAPP is to ensure the acquisition of data of sufficient quality and quantity to support essential Focused RI/FS decisions.

Further information on data management is included in the data management plan in Attachment V. A site data management system including field logs, sample management and tracking procedures, and document control and inventory procedures for both laboratory data and field measurements has been developed for the Environmental Restoration Program at the INEL Site.

The objective of the sample analysis/validation activity is to ensure that the data collected during the investigation are of adequate quality and quantity to support the risk assessment and the FS as defined in the Focused RI/FS Work Plan. Field monitoring collected during the treatability study will also be validated as defined in the work plan. The subsurface vapor field data obtained during the treatability study will be upgraded to an analytical Level III or IV by the use of an outside laboratory for use in the quantitative risk assessment as required and defined in the Focused RI/FS Work Plan.

Validation of data collected from OU 7-08 will be conducted in accordance with Sampling and Analysis Plan for the Organic Contamination in the Vadose Zone Operable Unit 7-08 Focused Remedial Investigation/Feasibility Study found in Attachment III of this document. Data will be evaluated for accuracy, precision, completeness, comparability, and representativeness. Levels and percentages of data validation will be determined in accordance with the required uses of the data. Once the data are validated through this process it will be transferred to the Environmental Restoration Data Management System described in the data management plan (see Attachment V).

5.5 Data Evaluation

All site investigation data including treatability field data will be evaluated. The evaluation will be logically organized so that relationships between site investigation results for each medium (groundwater, perched water, soil, soil gas, and air) are apparent. A data summary will be prepared that describes the quantities and concentration of specific VOCs in the vadose zone for inclusion in the Focused RI/FS. Ambient concentrations of VOCs surrounding the RWMC (vadose zone, groundwater, and atmosphere) will be measured. Statistical analyses of the data populations for each media will be performed. The potential transport mechanisms and the expected fate of the VOCs in the vadose zone will be modeled, and sensitivity analyses will be performed.

Data evaluation consists of reduction, tabulation, and evaluation of the data from each phase of the RI and begins after data validation has been completed. The goals of data evaluation are (a) to assess the need for additional sampling, and (b) to perform data interpretation.

Data evaluation to assess the need for additional sampling will apply to all subsurface investigation activities including soil, soil gas, perched water, and groundwater sampling/analyses, aquifer testing, and geophysical logging. Data evaluation will focus on the adequacy of the data in meeting risk assessment and remedial technology selection and design requirements.

The data interpretation process involves the reduction of data into maps, tables, graphs, and figures, and the use of subsurface transport and fate models to acquire a better understanding of the nature of VOC contamination at the site. The data evaluation process following any one subsurface investigation phase of the Focused RI/FS study will determine appropriate characterization and identify the appropriate remedial alternative.

Existing data and data from the RI will be compiled and evaluated in this activity. Concentrations of VOC contaminants will be compiled and evaluated in this activity. Concentrations of VOC contaminants in the surface soils will be summarized. Geologic data will be examined and correlated with borehole geophysical surveys to evaluate vadose zone contaminant migration.

Stratigraphic cross sections will be developed. Data generated from groundwater monitoring will be interpreted to establish hydraulic potential gradients and to estimate the flow of groundwater within the Snake River Plain Aquifer. Contaminant vapor plumes will be delineated and illustrated. Contaminant migration factors (retardation and dispersion) will be estimated from observations of VOC contaminant plume patterns and the physical and chemical characteristics of the contaminants. Particular attention will be given to determining the migration mechanism of the particular VOC contaminants at the site.

The potential sources will be evaluated for their contribution to the VOC contaminants in the groundwater. Correlations will be made between constituents in the vadose zone and waste sources. Impacts or the potential for impacts to the Snake River Plain Aquifer will be evaluated.

Data evaluation will identify further data gaps and reveal whether sufficient information and understanding of the site conditions have been obtained. If necessary, additional site characterization data may be identified for inclusion additional RI activities.

5.6 Risk Assessment

5.6.1 Risk Assessment Approach

The BRA will provide an evaluation of the potential threat to human health and the environment. The evaluation will identify possible contaminants and provide an analysis of the baseline risk to human health and the environment. The assessment includes four steps: hazardous substances identification, exposure assessment, toxicity assessment, and risk characterization. The risk assessment will be based on the following EPA guidance documents:

- *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual* (EPA 1989a)

- *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual* (EPA 1989b)

- *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988a)

- "Standard Default Exposure Factors" in *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual Supplemental Guidance,* OSWER Directive 9285.6-03 (EPA 1991).

The following sections of the work plan present the methodology for conducting the risk assessment upon completion of the forthcoming remedial investigation:

5.6.1.1 Hazardous Substances Identification. The identification of potential hazardous substances relevant to the human health and environmental evaluation will be based on available information. The maximum concentration available for exposure will be determined. The contaminant identification will include a screening of contaminants that pose the greatest hazard. The contaminants will be selected based on their quantity concentration, toxicity, persistence, and mobility. Carbon tetrachloride, tetrachloroethylene, trichloroethylene, chloroform, 1,1-dichloroethylene, 1,1,2,2-tetrachloroethane, 1,2-dichloropropane, and trichloroethane have been identified as being the primary contaminants of concern.

5.6.1.2 Exposure Assessment. The exposure assessment will identify actual or potential exposure pathways to characterize the potential exposed populations and to determine the extent of the exposure. After the exposure pathways are identified the analysis will address the frequency, mode, and magnitude of exposure. The exposure assessment will evaluate both present and future scenarios and receptors doses. A reasonable maximum exposure scenario will be addressed, based on the expected exposures at the site. A quantitative estimate of the expected exposure levels resulting from the actual or potential release of contaminants will be provided in the exposure assessment.

5.6.1.3 Toxicity Assessment. The toxicity assessment will evaluate potential adverse health and environmental effects associated with individual and multiple contaminant for noncarcinogens (reference doses) and carcinogens (slope factors) for the selected pathways.

5.6.1.4 Risk Characterization. The risk assessment will characterize the potential risks of adverse human health and environmental effects for each of the exposure scenarios evaluated in the exposure assessment. Integration of the exposure and toxicity assessments will characterize the potential or actual risk for carcinogens and noncarcinogens. The risk assessment will summarize the risks associated with each identified exposure route for contaminants of concern for human health and the environment.

5.6.2 Exposure Scenarios

Selected risk scenarios proposed for the BRA are presented in the paragraphs which follow. Those risk scenarios were based on the Pad A BRA and adapted to the specific site conceptual model for the OCVZ. If warranted by the results of the BRA, this evaluation will be used to estimate a VOC cleanup criteria. The BRA will be used to determine if remedial action is necessary.

Risk scenarios for the BRA include the following receptors: (a) workers on the SDA using groundwater from the RWMC production well for drinking and showering and inhaling VOCs emitted from the SDA surface, and (b) residential family at the boundary of the SDA using groundwater for drinking and showering; and inhaling VOCs emitted from the SDA surface. The relevant risk assessment guidelines and assumptions developed for Pad A RI/BRA were applied to OCVZ. Those assumptions were: (a) 100 years of institutional control from 1991, (b) transport calculations to determine future concentrations, and (c) a moving average (25 year occupational, 30 years residential) used in the risk assessment.

The exposure parameters to be used in scenarios are presented in Table 5-1. The first scenario involves current workers on the SDA using groundwater from the RWMC production well for drinking and showering; and inhaling VOCs emitted from the SDA surface using maximum projected concentration to groundwater and to atmosphere. The second scenario involves future workers on the SDA using groundwater from the RWMC production well for drinking and showering and inhaling VOCs emitted from the SDA surface using a 25-year moving average. The third future scenario involves a residential family using groundwater for drinking and showering and inhaling VOCs emitted from the SDA surface using a moving average with a 30-year time window. Exposure scenarios and risk assessment assumptions will be discussed among the agencies during the development of the BRA.

5.7 Treatability Study/Pilot Testing

The VVE treatability study will be performed using existing pilot-scale VVE facilities. Other treatability studies may be conducted as necessary to evaluate one or more of the candidate remedial technologies identified during the scoping process. The objectives of the VVE treatability studies are:

- Provide sufficient data to demonstrate the viability of the VVE technology as a remedial alternative.

- Determine cost and performance parameters for the VVE technology.

- Supply data for evaluation of the existing VVE and modifications to this system.

This treatability study will be initiated as part of the Focused RI/FS prior to the ROD. The existing VVE extraction well will be modified so that VOCs can be extracted from the 70-ft to 110-ft zone where organic vapor concentration appears to be greatest. This task in the Focused RI/FS work plan includes the development of a work plan for conducting the pilot treatability tests and preparing the treatability study report once the tests are complete. The activities that will be performed within this task are as follows:

- Prepare a treatability study work plan, which identifies scope and detailed plans for use of the existing VVE system to assess efficacy of the VVE and to reduce cost and performance uncertainties for treatment

- Modify existing VVE extraction well and treatment train to meet anticipated process changes (i.e., extraction zone location, extraction VOC concentration, air and tracer injection)

- Drill a new air injection and a new vapor monitor well to be used in operating and monitoring the VVE system

- Procure any additional test equipment

Table 5-1. Exposure parameters used in the exposure assessment of contaminants.

Exposure pathway	Exposure scenario	Intake rate[a]	Exposure frequency (d/y)[a]	Exposure duration (y)[a]	Body weight (kg)[a]
Ingestion of soil	Industrial	50 mg/d	250	25	70
	Residential	200 mg/d (child, 0-6)	350	6	15
		100 mg/d (adult)	350	24	70
Inhalation	Industrial	20 m^3/d	250	25	70
	Residential	20 m^3/d	350	30	70
Ingestion of water	Industrial	1 L/d	250	25	70
	Residential	2.2 L/d (infant, 0-3)[b]	350	3	12[b]
		0.81 L/d (child, 3-6)[b]	350	3	17[b]
		2 L/d (adult)	350	24	70

a. EPA 1991.

b. EPA 1990.

- Procure vendor services (i.e., carbon regeneration equipment or services, laboratory support)

- Analyze and validate field samples

- Evaluate test results

- Prepare and submit treatability study report, which will be part of the Focused RI/FS report.

Data needs will be evaluated based on existing technology data and existing site data. If this data are not adequate to screen or evaluate alternatives, additional treatability studies will be performed. If data from literature reviews and/or specific site data are adequate, further treatability studies will not be undertaken.

5.7.1 Pilot-Scale Studies

Pilot-scale tests are intended to simulate the conditions that exist in the field. Because the pilot-scale test attempts to more closely simulate actual conditions, much larger treatment units and waste volumes are required. Although efforts will be made to limit the size of the pilot units, it is necessary to maintain a size that allows thc appropriate data to be gathered.

Because pilot-scale tests often require the use of large volumes of waste, care will be taken to prevent further degradation of the site and to ensure safe handling and transport of the waste. Additionally, compliance with specific handling, transport, and discharge requirements will occur.

The pilot-scale studies will serve to more closely simulate application of candidate remedial technologies under actual field conditions.

A pilot-scale treatability work plan will be prepared consistent with the following format:

1. Project description and site background
2. Remedial technology description
3. Test objectives
4. Pilot plant installation and startup
5. Pilot plant operation and maintenance procedures
6. Parameters to be tested
7. Sampling plan
8. Analytical methods
9. Data management
10. Data analysis and interpretation
11. Health and safety
12. Residuals management.

A pilot-scale treatability study report will be completed upon termination of the pilot-scale tests and will detail the results of the tests. These results will be used as a basis for the selection of the technologies to be implemented at the site and included in the RI/FS and ROD.

5.7.2 Application of Results

The purpose of the treatability study is to provide information needed for detailed analysis of alternatives and to allow selection of a remedial action that has a reasonable certainty of achieving the response objectives. The test results will be used to ensure conventional and innovative treatment technologies are evaluated equally. The information generated during the treatability study also will be used in the design of the full-scale system.

Some of the technologies selected for detailed analysis for OU 7-08 may be well developed. Data collected during the RI may be adequate for evaluation of these without conducting treatability investigations. However, some technologies may not be sufficiently proven to predict technical feasibility, safety or environmental concerns, or treatment performance, or to estimate the size and cost of treatment units. Very limited research exists from which to draw generalizations regarding the advantages and limitations of many potential technologies. Additionally, some treatment processes are not sufficiently understood for performance to be predicted, even with a complete characterization of the wastes. When treatment performance is difficult to predict, actual testing of the process may help determine the appropriateness (e.g., technical feasibility, risk reduction, cost-effectiveness, societal acceptance) of potential remedial technologies. Some treatability investigations are being conducted on a Site-wide basis. Engineering, laboratory, and field scale tests are being performed on potential technologies such as VVE, waste retrieval, and in situ vitrification.

5.8 Remedial Investigation Report

A draft RI report will be prepared that summarizes the nature and extent of organic contamination in the vadose zone and presents the results of the BRA and fate and transport modeling. The draft RI report is a secondary document required pursuant to the FFA/CO and will contain the information necessary to support the Focused RI/FS process used to select appropriate remedy for mitigating the risk from organic contamination in the vadose zone. The RI report will be prepared in accordance with the suggested RI report format presented in EPA guidance (EPA 1988b). The information presented in the draft RI report will be a compilation of data collected from previous studies and site characterizations, as well as additional vadose zone, groundwater and atmosphere sampling, and analyses performed during the RI. When written comments on the draft RI report have been received from the EPA and IDHW, they will be incorporated into the final Focused RI/FS report.

5.9 Remedial Alternatives Development and Screening

The FS consists of three phases: development of remedial alternatives, screening of alternatives, and detailed analysis of alternatives. The three-phased approach follows current interim final guidance provided by the EPA in October 1988 (EPA 1988b).

Initial Phase I activity includes the development of remedial action objectives and general response actions for each medium of interest. These activities are outlined in Section 5.9.1. The process used to identify and screen technologies applicable to each general response action is summarized in Section 5.9.2. The process used to develop alternatives is described in Section 5.9.3.

5.9.1 Description of Current Situation and Proposed Response

Following an initial analysis of ARARs, a range of distinct hazardous waste management alternatives, which ensure protection of human health and the environment, will be identified and developed (see Section 3.4). These alternatives will remediate or control volatile organic contaminants in the vadose zone and control their migration to the groundwater and atmosphere. The potential alternatives will encompass a range of remediation alternatives that will reduce toxicity, mobility, or volume of contamination. A no-action alternative will also be included.

Information will be assembled, drawn mostly from the results of the RI, onsite background conditions, the nature and extent of organic contamination, and previous response activities. This information will be used in conjunction with the results of the risk assessment to develop remedial action objectives, general response actions, and estimates of the quantity of each medium at the SDA.

Remedial action objectives consist of medium-specific or operable unit-specific goals for protecting human health and the environment. The objectives should be as specific as possible, but not so specific that the range of alternatives that can be developed is unduly limited (refer to Section 3.6.1). These remedial action objectives are essentially remediation goals for the vadose zone, which will be based on VOC concentrations in the groundwater, soil, and atmosphere. Those VOC concentrations will be selected from the ARAR analysis and the BRA. Remedial action objectives identify VOC contaminants of concern, exposure routes, and allowable concentration of VOC contaminants (cleanup criteria) that can remain in the vadose zone, groundwater, and air after site remediation. The remedial action levels shall be determined on the basis of the results of the BRA and evaluation of the expected exposures and associated risks for each alternative.

General response actions are developed to satisfy the site-specific remedial action objectives. General response actions may include treatment, containment, excavation, disposal, institutional actions, or a combination of these. Like remedial action objectives, general response actions are medium-specific. General response actions that might be used at a site are initially defined during scoping and are refined throughout the Focused RI/FS as a better understanding of site conditions is gained and action-specific ARARs are identified.

A site-specific statement of purpose for the response will be prepared based on the results of the RI and risk assessment. This statement will identify the actual or potential contamination sources and exposure pathways to be addressed by the remedial action alternatives. The approach described below follows the interim final guidance given by the EPA in October 1988 (EPA 1988b).

5.9.2 Preliminary Remedial Technologies

5.9.2.1 Appropriate Technologies. A list will be compiled of all technologies that could be used to remediate the contamination problems at the SDA. The technologies will be grouped into the following general response actions:

- In situ treatment
- Excavation, Treatment and Disposal
- Institutional controls
- Containment
- No action

A list of technologies that may be considered for use at the SDA is discussed in Section 3.6.2.

One or more technology types will be identified for each general response action. Each technology type will be subdivided into several technology process options.

5.9.2.2 Screening of Technologies. The master list of preliminary technologies described in RI/FS Guidance document (EPA 1988b) will be screened to eliminate those process options that are clearly unsuitable for OU 7-08. This screening of technologies will be based on effectiveness, implementability, and to a lesser extent, cost factors.

Specific technology processes that have been identified will be evaluated further depending on their effectiveness relative to other processes within the same technology type. This evaluation will focus on (a) the potential effectiveness of process options in handling the estimated volumes of VOC vapor in the vadose zone and meeting the remediation goals identified in the remedial action objectives, (b) the potential impacts to human health and the environment during the construction and implementation phase, and (c) how proven and reliable the process is with respect to the VOC contaminants and site conditions.

Implementability encompasses both the technical and administrative feasibility of implementing a technology process. Technical implementability is used as an initial screen of technology types and process options to eliminate those that are clearly ineffective or unworkable at a site. Administrative aspects of implementability, such as the availability of treatment, storage, and disposal services (including capacity) and the availability of necessary equipment and skilled workers to implement the technology, are considered as well.

Cost plays a limited role in the screening of process options. Relative capital and operation and maintenance costs are used rather than detailed estimates. At this stage in the process, the cost analysis is made on the basis of engineering judgment, and each process is evaluated as to whether costs are high, low, or medium relative to other process options of the same technology type.

Elimination of any technology during the screening process will be fully documented in the final report.

5.9.3 Development of Alternatives

Site-specific remedial response objectives will be established prior to formulating alternatives. The objectives will be based on the risk assessment and other appropriate guidance. Alternatives will be developed that protect human health and the environment by eliminating, reducing, or controlling risks posed by the site.

In assembling alternatives, general response actions and the process options chosen to represent the various technology types for each medium are combined to form alternatives for the SDA as a whole. Often more than one general response action will be applied to each medium. For example, alternatives for remediating soil VOC contamination will depend on the compounds and distribution of VOC contaminants and may include vacuum extraction for some of the site and capping of other parts of the site.

For source control actions that are to be undertaken as part of a separate operable unit, the following alternatives will be developed (EPA 1988b):

- A range of alternatives that employ treatment to reduce the toxicity, mobility, or volume of the VOC contamination.

- One or more alternatives that involve little or no treatment, but provide for adequate protection of human health and the environment. Engineering controls (containment) or institutional controls are examples of this group of alternatives.

- A no-action alternative.

5.9.4 Screening of Alternatives

Alternatives will be screened on the basis of the short- and long-term aspects of their effectiveness, implementability, and cost. To the extent practicable, a wide range of alternatives will be preserved.

5.9.4.1 Effectiveness. A key aspect of the screening evaluation is the effectiveness of each alternative in protecting human health and the environment. Each alternative developed during Phase I will be evaluated as to its effectiveness in providing protection and the reductions in toxicity, mobility, or volume that it will achieve. Both short- and long-term components of effectiveness should be evaluated. Short-term refers to the period until the remedial action is complete. Reduction of toxicity, mobility, or volume refers to changes in one or more characteristics of the VOC compounds or contaminated media caused by the use of a treatment that decreases the inherent threats or risks associated with the VOC contamination.

5.9.4.2 Implementability. Implementability is a measure of both the technical and administrative feasibility of constructing, operating, and maintaining a remedial action alternative. Technical feasibility is the ability to construct, reliably operate, and meet technology-specific regulations for process options. Administrative feasibility refers to the ability to obtain approvals from agencies; availability of treatment, storage, and disposal services (and capacity); and the requirements for, and availability of, specific equipment and technical specialists.

5.9.4.3 Cost. Absolute cost estimate accuracy during screening is not essential. The focus will be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the screening process.

Both capital and operation and maintenance costs will be considered, where appropriate, during the screening of alternatives. The evaluation will include those operation and maintenance costs that will be incurred for as long as necessary, even after the initial remedial action is complete. In addition, potential future remedial action costs will be considered during alternative screening to the extent that they can be defined. Present worth analyses will be used during alternative screening to evaluate expenditures that occur over different time periods.

5.9.4.4 Selection of Alternatives for Detailed Analysis. The identification of possible remedial technologies and process options will occur by first narrowing the list of candidate alternatives that are related to mitigating the organic contamination in the vadose zone and technically feasible for use at the RWMC. The study will then evaluate and screen the identified technologies and process options based upon implementability, effectiveness, and cost so a reasonable number of alternatives will remain for detailed alternative analysis.

The results of the screening process will be reviewed by EG&G Idaho, DOE-ID, EPA, the State of Idaho, and other personnel. This review will result in an agreed upon set of alternatives that will undergo detailed analysis.

5.10 Detailed Analysis of Alternatives

Remediation technologies and process options that remain after the initial development and screening discussed in Section 5.9 will be combined into comprehensive alternatives to address the problems associated with OU 7-08. A range of remediation alternatives will be developed that represent distinct, viable approaches to addressing organic contamination in the vadose zone. A no-action alternative will also be developed and will serve as a baseline to compare other action alternatives. A detailed analysis will be conducted on alternatives that represent viable approaches remaining after the screening process outlined in Section 5.9.4 has been completed. The detailed analysis will consist of an assessment of individual alternatives against the nine evaluation criteria discussed below. Then a comparative analysis will be conducted, focusing upon the relative performance of each alternative against the criteria. A summary of the tradeoffs among alternatives will be made. This analysis will reflect an environmental assessment similar to the one conducted under NEPA and provide a discussion of potential effects as well as possible mitigation.

5.10.1 Overall Protection of Human Health and the Environment

Alternatives will be assessed as to whether they can adequately protect human health and the environment by eliminating, reducing, or controlling risks.

5.10.2 Compliance with ARARs

The alternatives will be assessed to determine whether they attain ARARs of Federal and State environmental and public health laws or provide grounds for invoking one of the waivers under the proposed 40 CFR 300.430 (f)(3)(iv).

5.10.3 Long-Term Effectiveness and Permanence

Alternatives will be assessed to determine the long-term effectiveness and permanence they afford, along with the degree of certainty that each alternative will prove successful. Factors will include

- A total risk assessment made for each alternative to evaluate the cumulative effects of both long-term and short-term risks associated with the implementation of the remedial alternative

- The type, degree, and adequacy of long-term management required, including engineering controls, institutional controls, monitoring, operation, and maintenance

- Long-term reliability of controls, including uncertainties associated with land disposal of untreated hazardous waste and treatment residuals

- The potential need for replacement of the remedy.

5.10.4 Reduction of Toxicity, Mobility, or Volume

The degree to which alternatives employ treatments that reduce toxicity, mobility, or volume will be assessed. Factors that will be considered include

- The type of process options employed in an alternative and what materials they will treat

- Amount of VOC contamination that will be destroyed or treated

- The degree of expected reduction in toxicity, mobility, or volume

- The degree to which the treatment is irreversible

- Residuals that will remain and by-products that will be created following treatment.

5.10.5 Short-Term Effectiveness

Short-term effectiveness of alternatives will be assessed considering:

- A risk assessment made for each alternative to evaluate short-term risks that might be posed to the community during implementation

- Potential impacts on workers conducting remedial actions and the effectiveness and reliability of protective measures

- Potential environmental impacts of remedial actions and the effectiveness and reliability of mitigative measures during implementation

- The time until protection is achieved.

5.10.6 Implementability

The ease or difficulty of implementing the alternatives will be assessed by considering:

- Degree of difficulty or uncertainty associated with construction and operation of the technology

- Expected operational reliability and the ability to undertake additional action, if required

- Ability and time required to obtain necessary approvals and permits from the agencies

- Availability of necessary equipment and specialists

- Available capacity and location of needed treatment, storage, and disposal services

- Timing of the availability of prospective technologies that may be under development.

5.10.7 Costs

Costs will be assessed including capital costs and operation and maintenance costs based on present value. The costs will be developed with an accuracy of +50% to -30% (as specified in the EPA RI/FS guidance document) (EPA 1988b) unless otherwise stated in the FS.

5.10.8 State Acceptance

Concerns identified by the State of Idaho during its review of the Focused RI/FS Work Plan will be assessed. This review will consider the proposed use of waivers, the selection process used to evaluate alternatives, and other actions. When comments have been received from the State, they will be incorporated into the remedial evaluation.

5.10.9 Community Acceptance

Community attitudes toward the alternatives will be assessed. Again, as with the State's acceptance, complete assessment will not be possible until comments have been received on the proposed action. However, a CRP (see Attachment II) has been developed that provides for informing and involving the adjacent community throughout the process. This is likely to assist in accommodating community concerns.

These nine criteria are categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The first two criteria, overall protection of human health and the environment and compliance with ARARs, are the threshold criteria that must be met in order for an alternative to be eligible for selection. The third to seventh criteria are the primary balancing criteria and are designed to compare the relative tradeoffs among the alternatives. The last two criteria are the modifying criteria and will be addressed in the ROD following public comment on the Focused RI/FS report and proposed plan.

5.11 RI/FS Final Reports

A draft Focused RI/FS report will summarize the result of all previous field investigations, results of any treatability studies, ARAR analysis, risk assessment, and remedial alternatives. The Focused RI/FS report is defined as a primary document in the action plan. The Focused RI/FS report will serve as a basis for consolidating information that has been obtained and will document the rationale used to screen and develop remedial actions to remove organic contamination in the vadose zone. The Focused RI/FS report will contain the information needed by the decisionmakers to select an appropriate remedy for organic contamination in the vadose zone. The elements of the Focused RI/FS report will follow the basic format found in Table 6-5 of the Focused RI/FS guidance (EPA 1988b). Supporting data, information, and calculations will be included in the appendices to the report. Once written comments on the draft Focused RI/FS report are received from EPA, DOE, and IDHW, a final Focused RI/FS report will be prepared reflecting the comments.

5.12 Post Focused RI/FS Activities

This task includes the preparation of a proposed plan and an ROD. The proposed plan, a secondary document as defined in the action plan, will be prepared to facilitate public participation in the remedy selection process. During completion of the Focused RI/FS report, the proposed plan for organic contamination in the vadose zone will be drafted. This plan will outline the proposed remediation plans developed and supported by the Focused RI/FS activities. The proposed plan will be written per the suggested format found within *The Guidance on Preparing Superfund Decision Documents* (EPA 1989b). The proposed plan will be presented to the public and any issues raised during the public comment period will be addressed in the responsiveness summary of the ROD.

Public involvement in the decision process is vital to the successful implementation of a remediation alternative. Public participation in the decision process will be conducted per the proposed plan section of the *Guidance on Preparing Superfund Decision Documents* (EPA 1989b).

Following receipt of agency and public comments on the Focused RI/FS report and proposed plan, a remedy for OU 7-08 will be selected and documented in the ROD, which will be signed by the parties specified in the FFA/CO. The ROD will be prepared in accordance with *Guidance on Preparing Superfund Decision Documents* (EPA 1989b). The ROD will serve the following three functions:

- Certify that the remedy selection process was carried out in accordance with the FFA/CO, CERCLA, and to the extent practicable, with the NCP

- Describe the technical parameters of the remedy, specifying the treatment, engineering, and institutional components, as well as remediation goals

- Provide the public with a consolidated source of information about the site and the chosen remedy, including the rationale behind the selection.

5.13 Enforcement Support

This task encompasses activities conducted in support of enforcement aspects of the project at any time during the Focused RI/FS process. These activities include preparation of briefing materials, meeting attendance, and task management and quality control functions. Enforcement support will be provided as required.

5.14 Miscellaneous Support

This task encompasses activities conducted in association with the vadose zone Focused RI/FS that are outside the normal Focused RI/FS scope of work. The CRP and the administrative record will be implemented to ensure that Focused RI/FS information is made available to Federal and State agencies and interested members of the community throughout the Focused RI/FS process. These activities are discussed below:

5.14.1 Community Relations Plan

The INEL has prepared the a community relations plan for OU 7-08 (see Attachment II). This plan identifies community relation activities and encourages meaningful input from interested members of the community during the Focused RI/FS process for OU 7-08. In order to ensure that local communities are provided with ample opportunity to participate during the OCVZ Focused RI/FS, a schedule for community relations activities is provided in Table 1 of the Community Relations Plan (see Attachment II). The INEL has established information repositories in Idaho Falls, Pocatello, Twin Falls, Boise, and Moscow, Idaho.

5.14.2 Administrative Record

The administrative record for OU 7-08 is being established. The administrative record will meet the requirements of EG&G Idaho ERD Directive 1.8. The administrative record will be a comprehensive compilation of technical, legal, and informational documents and correspondence concerning OU 7-08. The administrative record is located in Idaho Falls to ensure that the public has access to important decisionmaking information. An index to the administrative record will be placed in the information repositories and updated regularly.